the effects of various fertilizers, including stable and green manures, upon wheat seedlings grown in pots. These were checked by field experiments, the results being mainly concordant. Here is presented the largest number of experiments yet made under uniform conditions, and while the conditions are still too complex for full analysis, the trend of the results is clear. Though in certain cases the composition of the soil as modified by the fertilizer is an important factor, it is rarely so important as the physical change. In very many cases, indeed, the crop yield can be as greatly increased by proper manipulation of the soil as by adding any sort of fertilizer. The experiments also indicate that the fertilizing of a particular field or region is a local problem, since even the same soil "types" from different localities show different results with the same fertilizer. (This may also be taken to indicate that the basis of classification of soils used by the Bureau is unnatural.)

Everyone who is interested in the growth of plants, either theoretically or practically, should read and reflect on these bulletins.—C. R. B.

Reduction and fertilization in Polytrichum.—The mosses have received practically no attention from cytologists. The small nuclei and some difficulties in technique are doubtless responsible for this neglect. A paper by the Drs. VAN LEEUWEN-REIJNVAAN[6] presents the results of an extended investigation of *Polytrichum piliferum*, *P. juniperinum*, *P. formosum*, and *P. commune*.

In spermatogenous tissue the nucleus contains a large deeply staining mass from which the chromosomes arise. From this mass there is cut off a small body which passes out of the nucleus into the cytoplasm and divides to form two centrosomes. These behave like typical centrosomes, and in the telophase are included within the nuclear membrane. At the last mitosis they remain in the cytoplasm and become blepharoplasts. At the same time a large piece of chromatin, which may be called a *Nebenkern*, is cut off and cast out into the cytoplasm, where it gradually degenerates.

In the sporogonium the mitoses show 12 chromosomes, 4 long, 4 short, and 4 medium. In the gametophyte there are 6 chromosomes, of which 2 are long, 2 short, and 2 medium. At the last spermatogenous division the 6 chromosomes unite in pairs, fusing longitudinally, so that one counts 3 chromosomes. Hence, the sperm contains 3 chromosomes, one long, one short, and one medium. At the division of the central cell of the archegonium, the ventral canal cell and egg cell each contain 3 chromosomes, one long, one short, and one medium. These two cells fuse with each other, and the egg, formed in this manner, is fertilized by two sperms. The fertilized egg contains 12 chromosomes, 3 from the egg proper, 3 from the ventral canal cell, and 3 from each of the two sperms. The

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[6] VAN LEEUWEN-REIJNVAAN, J. and W., Ueber eine zweifache Reduktion bei der Bildung der Geschlechtszellen und darauf folgende Befruchtung mittels zwei Spermatozoiden und über die Individualität der Chromosomen bei einigen Polytrichumarten. Recueil Trav. Bot. Neerl. 4: (pp. 44. *pls.* 2). 1907.

writers believe that this behavior of the chromatin in Polytrichum supports the theory of the individuality of the chromosomes.

Commenting upon the above results from the standpoint of one not personally familiar with mitotic figures in mosses, abundant confirmation is needed before the account as a whole can be accepted. We are inclined to believe that the observations are largely correct and that the situation is extremely interesting, but that the final interpretation will not be so widely divergent from current notions of reduction and fertilization as the one proposed.—CHARLES J. CHAMBERLAIN.

Ginkgo.—Under the broad title *Ginkgo biloba* SPRECHER[7] gives a rather full account of the genus, arranged according to the following outline: embryo, young plant, leaf, secondary structure, flowers, pollen and fertilization, geographical distribution, uses and culture, fossils, and conclusions. Instead of giving a historical résumé followed by his own investigations, he has simply followed the above outline, using the available accounts and illustrations, and then filling in the gaps from his own investigations. With so large a subject and so many gaps to fill, an exhaustive investigation of any particular feature could hardly be expected. Most of the original work deals with floral development, leaf development, and anatomy. While the author has studied the gametophyte, it is in this field that he is most indebted to previous investigators. A large number of abnormalities in ovules, stamens, and sporophylls are recorded.

Of course there must be a guess at the phylogeny. While the sperms and certain characters of the ovules resemble those of cycads, in most respects Gingko is nearer the Taxaceae. Both Ginkgo and the Taxaceae have come from a Filicales stock which has given rise to the Cycadophytes and also to the Cordaitales and Ginkgoales, the point of departure being in the neighborhood of the fossil Botryopteridaceae.

The book will be useful for reference. It should be regarded as a compilation, supplemented by extensive personal observations, rather than as a work in which research is the predominant feature.—CHARLES J. CHAMBERLAIN.

SHAW[8] has investigated the vascular anatomy of the ovulate strobilus of Ginkgo, chiefly with reference to the morphological nature of the "collar." From aberrant material, which seems to appear abundantly enough under Japanese cultivation, it has been inferred that this collar is a much reduced megasporophyll. From this current view SHAW dissents, on the basis of testimony obtained from the vascular anatomy. The vascular tissue of the collar is "inverted," and a comparison with Lagenostoma shows a similar situation in that seed. The author therefore suggests that the collar of the Ginkgo ovule is a vestige of the well-developed cupule found investing the seeds of many of the Cycadofilicales. —J. M. C.

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[7] SPRECHER, ANDREAS, Le *Ginkgo biloba* L. pp. 208. *figs. 225.* Genève. 1907.

[8] SHAW, F. J. F., A contribution to the anatomy of *Ginkgo biloba.* New Phytol. 7:85–92. *figs. 16–18.* 1908.